

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of :

M. Nakashima et al.

Group Art Unit: To Be Assigned

Serial No.: Division of 09/129,950

Examiner: To Be Assigned

Filed: June 25, 2001

For: HIGH MOLECULAR WEIGHT SILICONE COMPOUNDS, RESIST  
COMPOSITIONS, AND PATTERNING METHOD

**PRELIMINARY AMENDMENT**

Assistant Commissioner for Patents  
Washington, D.C. 20231

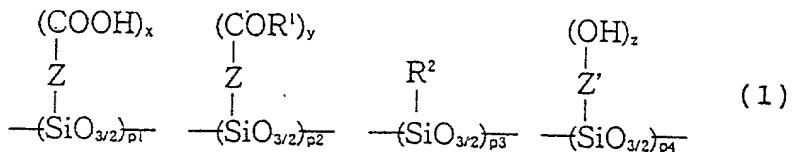
Sir:

Prior to initial examination, please amend the above-identified application as indicated below and consider the remarks which follow:

**IN THE CLAIMS:**

Please cancel claims 1 and 6-15 without prejudice or disclaimer.

2. (Amended) A high molecular weight silicone compound comprising recurring units represented by formula (1), said silicone compound having a weight average molecular weight of 1,000 to 50,000,



wherein Z is a divalent to hexavalent, non-aromatic, monocyclic or polycyclic hydrocarbon or bridged cyclic hydrocarbon group having 5 to 12 carbon atoms; Z' is a divalent to hexavalent, normal or branched hydrocarbon group having 1 to 20 carbon atoms or non-aromatic, monocyclic or polycyclic hydrocarbon or bridged cyclic hydrocarbon group having 3 to 20 carbon atoms; Z or Z' may have a nitrogen, oxygen or sulfur atom interposed in a carbon-to-carbon bond, the hydrogen atom on a carbon atom may be replaced by a halogen, alkoxy, nitro, cyano or acetyl group, and a methylene group in the carbon skeleton may be replaced by a carbonyl group;

x, y and z are independently integers of 1 to 5 corresponding to the valence of Z and Z';

R<sup>1</sup> is a group represented by formula (2a) or (2b); R<sup>2</sup> is a normal, branched or cyclic, substituted or unsubstituted, alkyl group having 1 to 8 carbon atoms or alkenyl group having 3 to 8 carbon atoms or a monovalent, non-aromatic, polycyclic hydrocarbon or bridged cyclic hydrocarbon group having 5 to 12 carbon atoms;



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wherein R is hydrogen, hydroxyl group or a normal, branched or cyclic alkyl group having 1 to 20 carbon atoms, R' is a normal, branched or cyclic alkenylene group having 1 to 20 carbon atoms, an alkyl R or an alkylene R' group may have an oxygen atom interposed in a carbon-to-carbon bond, some of the hydrogen atoms attached to carbon atoms may be replaced by hydroxyl groups; or R and R', taken together, may form a ring, and each of R and R' is a normal or branched alkylene group of 1 to 8 carbon atoms when they form a ring; and

p1 is a positive number and p2, p3 and p4 are 0 or positive numbers and satisfy:

$$p1+p2+p3+p4 = 1,$$

$$0 < p1/(p1+p2+p3+p4) \leq 0.9,$$

$$0 \leq p2/(p1+p2+p3+p4) \leq 0.8,$$

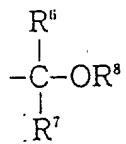
$$0 \leq p3/(p1+p2+p3+p4) \leq 0.7,$$

$$0 \leq p4/(p1+p2+p3+p4) \leq 0.9,$$

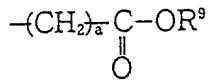
wherein some or all of the hydrogen atoms of carboxyl groups or carboxyl groups and hydroxyl groups in silicone compound of formula (1) are replaced by at least one acid labile group, said silicone compound having a weight average molecular weight of 1,000 to 50,000.

3. (Amended) The high molecular weight silicone compound of claim 2 wherein the acid labile group is at least one group selected from the class consisting of formula (4), formula (5), tertiary alkyl groups of 4 to 20 carbon atoms, trialkylsilyl groups whose alkyl groups each have 1 to 6 carbon atoms, and oxoalkyl groups of 4 to 20 carbon atoms,

(4)



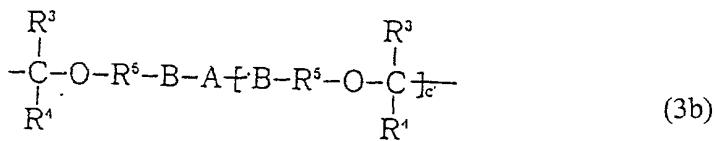
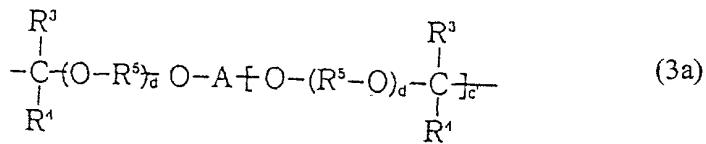
(5)



wherein R<sup>6</sup> and R<sup>7</sup> each are independently hydrogen or a normal, branched or cyclic alkyl group of 1 to 18 carbon atoms, R<sup>8</sup> is a monovalent hydrocarbon group of 1 to 18 carbon atoms which may have a hetero atom, or R<sup>6</sup> and R<sup>7</sup>, R<sup>6</sup> and R<sup>8</sup>, or R<sup>7</sup> and R<sup>8</sup>, taken together, may form a ring, and R<sup>6</sup>, R<sup>7</sup> and R<sup>8</sup> each are independently a normal or branched alkylene group of 1 to 18 carbon

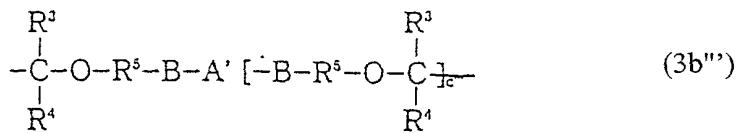
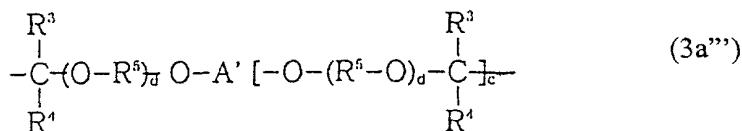
atoms when they form a ring, R<sup>9</sup> is a tertiary alkyl group of 4 to 20 carbon atoms, a trialkylsilyl group whose alkyl groups each have 1 to 6 carbon atoms, an oxoalkyl group of 4 to 20 carbon atoms or a group of formula (4), and letter a is an integer of 0 to 6.

4. (Amended) The high molecular weight silicone compound of claim 2 wherein some of the hydrogen atoms of carboxyl groups or carboxyl groups and hydroxyl groups in said silicone compound are replaced by at least one acid labile group, and 0 mol% to 50 mol% of the hydrogen atoms of the carboxyl groups and/or hydroxyl groups are replaced by crosslinking groups having C-O-C linkages represented by formula (3a) or (3b) whereby the silicone compound is crosslinked within a molecule and/or between molecules,



wherein each of R<sup>3</sup> and R<sup>4</sup> is independently hydrogen or a normal, branched or cyclic alkyl group of 1 to 8 carbon atoms, or R<sup>3</sup> and R<sup>4</sup>, taken together, may form a ring, and each of R<sup>3</sup> and R<sup>4</sup> is independently a normal or branched alkylene group of 1 to 8 carbon atoms when they form a ring, R<sup>5</sup> is a normal, branched or cyclic alkylene group of 1 to 10 carbon atoms, d is 0 or an integer of 1 to 10, A is a c-valent aliphatic or alicyclic saturated hydrocarbon group, aromatic hydrocarbon group or heterocyclic group of 1 to 50 carbon atoms, which may have an intervening hetero atom and in which the hydrogen atom attached to a carbon atom may be partially replaced by a hydroxyl group, carboxyl group, acyl group or fluorine atom, B is -CO-O-, -NHCO-O- or -NHCONH-, c is an integer of 2 to 8, and c' is an integer of 1 to 7.

5. (Amended) The high molecular weight silicone compound of claim 4 wherein the crosslinking group having C-O-C linkages represented by formula (3a) or (3b) is represented by the formula (3a'') or (3b''):



wherein each of  $\text{R}^3$  and  $\text{R}^4$  is independently hydrogen or a normal, branched or cyclic alkyl group of 1 to 8 carbon atoms, or  $\text{R}^3$  and  $\text{R}^4$ , taken together, may form a ring, and each of  $\text{R}^3$  and  $\text{R}^4$  is independently a normal or branched alkylene group of 1 to 8 carbon atoms when they form a ring,  $\text{R}^5$  is a normal, branched or cyclic alkylene group of 1 to 10 carbon atoms,  $d$  is 0 or an integer of 1 to 5,  $\text{A}'$  is a  $c''$ -valent normal, branched or cyclic alkylene, alkyltriyl or alkyltetrayl group of 1 to 20 carbon atoms or arylene group of 6 to 30 carbon atoms, which may have an intervening hetero atom and in which the hydrogen atom attached to a carbon atom may be partially replaced by a hydroxyl group, carboxyl group, acyl group or fluorine atom,  $\text{B}$  is  $-\text{CO}-\text{O}-$ ,  $-\text{NHCO}-\text{O}-$  or  $-\text{NHCONH}-$ ,  $c''$  is an integer of 2 to 4, and  $c'''$  is an integer of 1 to 3.

Please add the following new claims 16-21.

-- 16. A resist composition comprising

(A) an organic solvent,

(B) a base resin in the form of the high molecular weight silicone compound of claim 3, and

(C) a photoacid generator.

17. A resist composition comprising

(A) an organic solvent,

(B) a base resin in the form of the high molecular weight silicone compound of claim 5, and

(C) a photoacid generator.

18. The resist composition of claim 4 further comprising (D) a dissolution inhibitor.

19. The resist composition of claim 4 further comprising (E) a basic compound.

20. The resist composition of claim 4 further comprising (F) a compound having a group represented by  $\equiv\text{C}-\text{COOH}$  in a molecule.

21. The resist composition of claim 4 further comprising (G) an acetylene alcohol derivative. --

## REMARKS

Claims 1 and 6-15 (as well as claims 16-27, which were added during prosecution) were allowed in the parent application, 09/129,950, and have been canceled in the present application. The remaining claims, claims 2-5, were subject to a restriction requirement in the parent and are presently under consideration herein.

Applicants note that claims 2-3 (restricted into Group II in the parent application, and

drawn to, in the Examiner's words, "a silicone compound with acid labile groups") and claims 4-5 (restricted into Group III in the parent application, and drawn to, in the Examiner's words, "a cross-linked silicone compound with acid labile groups" are subsets of claims which were allowed in the parent application. For example, some of the allowed claims in the parent are drawn to resist compositions which comprise compounds having acid labile groups (compare, *e.g.*, composition claim 7 and the claims which depend from it). Furthermore, other allowed claims in the parent are drawn to resist compositions which comprise compounds that are cross-linked [compare, *e.g.*, composition claim 8 (which corresponds directly to instant compound claim 4) and claim 14]. Because the compositions which comprise compounds that have acid labile groups, and/or which are cross-linked, are free of the prior art of record, the comparable compounds, themselves, must be patentable. Claims 2-5 have been amended herein to render them consistent with composition claims as amended in the parent application.

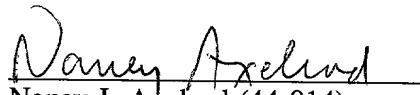
Furthermore, it is noted that claims 2-3 (restricted into Group II in the parent application) and claims 4-5 (restricted into Group III in the parent application) should not be restricted from one another in the present Divisional application. Not only are all of these claims subsets of claims allowed in the parent application, but they also recite overlapping subject matter and thus are not restrictable. The compounds of Group II comprise acid labile groups, as do the compounds of Group III, which are cross-linked silicone compound(s) with acid labile groups. A search of one of these groups requires a search of the other; thus, a search of both groups would not constitute an undue search burden. Furthermore, at least claim 2 (of Group II) and claim 4 (of Group III) are related as combination/subcombination. The cross-linked silicone compound

of claim 4 requires the particulars of the compound of claim 2. Therefore, the groups are not  
restrictable. MPEP 806.05(c)

Therefore, it is believed that the present claims are condition for allowance, which action  
is respectfully requested.

Respectfully submitted,

  
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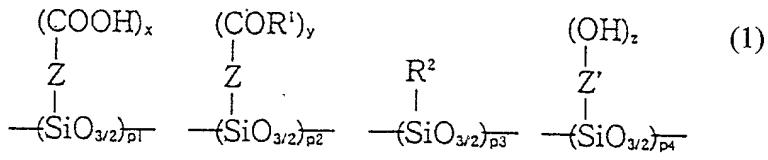
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**Filed: June 25, 2001**

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MARKED-UP VERSION

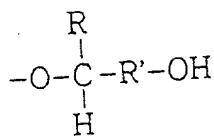
2. (Amended) A The high molecular weight silicone compound of claim 1 comprising recurring units represented by formula (1), said silicone compound having a weight average molecular weight of 1,000 to 50,000,



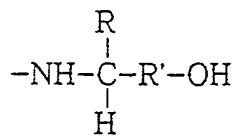
wherein Z is a divalent to hexavalent, non-aromatic, monocyclic or polycyclic hydrocarbon or bridged cyclic hydrocarbon group having 5 to 12 carbon atoms; Z' is a divalent to hexavalent, normal or branched hydrocarbon group having 1 to 20 carbon atoms or non-aromatic, monocyclic or polycyclic hydrocarbon or bridged cyclic hydrocarbon group having 3 to 20 carbon atoms; Z or Z' may have a nitrogen, oxygen or sulfur atom interposed in a carbon-to-carbon bond, the hydrogen atom on a carbon atom may be replaced by a halogen, alkoxy, nitro, cyano or acetyl group, and a methylene group in the carbon skeleton may be replaced by a carbonyl group;

x, y and z are independently integers of 1 to 5 corresponding to the valence of Z and Z';

R<sup>1</sup> is a group represented by formula (2a) or (2b); R<sup>2</sup> is a normal, branched or cyclic, substituted or unsubstituted, alkyl group having 1 to 8 carbon atoms or alkenyl group having 3 to 8 carbon atoms or a monovalent, non-aromatic, polycyclic hydrocarbon or bridged cyclic hydrocarbon group having 5 to 12 carbon atoms;



(2a)



(2b)

wherein R is hydrogen, hydroxyl group or a normal, branched or cyclic alkyl group having 1 to 20 carbon atoms, R' is a normal, branched or cyclic alkenylene group having 1 to 20 carbon atoms, an alkyl R or an alkylene R' group may have an oxygen atom interposed in a carbon-to-carbon bond, some of the hydrogen atoms attached to carbon atoms may be replaced by hydroxyl groups; or R and R', taken together, may form a ring, and each of R and R' is a normal or branched alkylene group of 1 to 8 carbon atoms when they form a ring; and

p1 is a positive number and p2, p3 and p4 are 0 or positive numbers and satisfy:

$$\underline{p_1+p_2+p_3+p_4 = 1},$$

$$\underline{0 < p_1/(p_1+p_2+p_3+p_4) \leq 0.9},$$

$$\underline{0 \leq p_2/(p_1+p_2+p_3+p_4) \leq 0.8},$$

$$\underline{0 \leq p_3/(p_1+p_2+p_3+p_4) \leq 0.7},$$

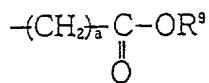
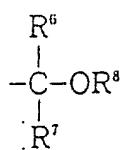
$$\underline{0 \leq p_4/(p_1+p_2+p_3+p_4) \leq 0.9},$$

wherein some or all of the hydrogen atoms of carboxyl groups or carboxyl groups and hydroxyl groups in silicone compound of formula (1) are replaced by acid labile groups of at least one acid labile type group,

said silicone compound having a weight average molecular weight of 1,000 to 50,000.

3. (Amended) The high molecular weight silicone compound of claim 2 wherein the acid labile group is at least one group selected from the class consisting of ~~groups of the following general formula (4), groups of the following general formula (5), tertiary alkyl groups of 4 to 20 carbon atoms, trialkylsilyl groups whose alkyl groups each have 1 to 6 carbon atoms, and oxoalkyl groups of 4 to 20 carbon atoms,~~

(4)

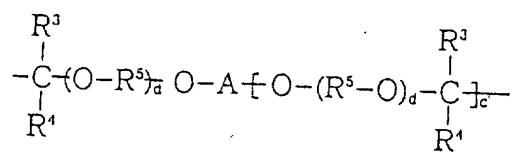


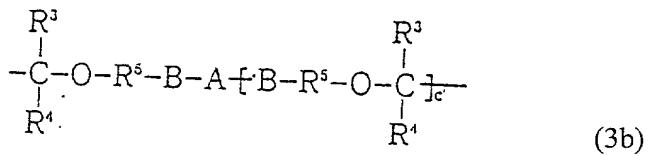
(5)

wherein R<sup>6</sup> and R<sup>7</sup> each are independently hydrogen or a normal, branched or cyclic alkyl group of 1 to 18 carbon atoms, R<sup>8</sup> is a monovalent hydrocarbon group of 1 to 18 carbon atoms which may have a hetero atom, or R<sup>6</sup> and R<sup>7</sup>, R<sup>6</sup> and R<sup>8</sup>, or R<sup>7</sup> and R<sup>8</sup>, taken together, may form a ring, and R<sup>6</sup>, R<sup>7</sup> and R<sup>8</sup> each are independently a normal or branched alkylene group of 1 to 18 carbon atoms when they form a ring, R<sup>9</sup> is a tertiary alkyl group of 4 to 20 carbon atoms, a trialkylsilyl group whose alkyl groups each have 1 to 6 carbon atoms, an oxoalkyl group of 4 to 20 carbon atoms or a group of the above general formula (4), and letter a is an integer of 0 to 6.

4. (Amended) The high molecular weight silicone compound of claim 2 wherein some of the hydrogen atoms of carboxyl groups or carboxyl groups and hydroxyl groups in said silicone compound are replaced by ~~acid labile groups of~~ at least one acid labile group type, and ~~more than~~ 0 mol% to 50 mol% of the hydrogen atoms of the carboxyl groups and/or hydroxyl groups are replaced by crosslinking groups having C-O-C linkages represented by ~~the following~~ general formula (3a) or (3b) whereby the silicone compound is crosslinked within a molecule and/or between molecules,

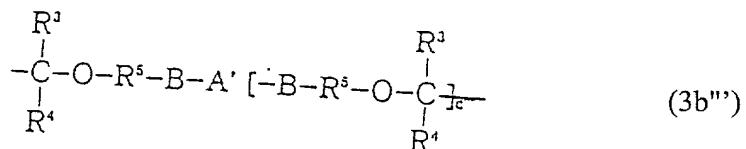
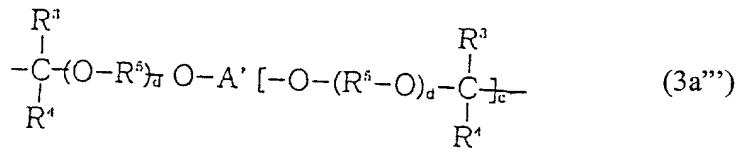
(3a)





wherein each of  $\text{R}^3$  and  $\text{R}^4$  is independently hydrogen or a normal, branched or cyclic alkyl group of 1 to 8 carbon atoms, or  $\text{R}^3$  and  $\text{R}^4$ , taken together, may form a ring, and each of  $\text{R}^3$  and  $\text{R}^4$  is independently a normal or branched alkylene group of 1 to 8 carbon atoms when they form a ring,  $\text{R}^5$  is a normal, branched or cyclic alkylene group of 1 to 10 carbon atoms, letter  $d$  is 0 or an integer of 1 to 10,  $\text{A}$  is a  $c$ -valent aliphatic or alicyclic saturated hydrocarbon group, aromatic hydrocarbon group or heterocyclic group of 1 to 50 carbon atoms, which may have an intervening hetero atom and in which the hydrogen atom attached to a carbon atom may be partially replaced by a hydroxyl group, carboxyl group, acyl group or fluorine atom,  $\text{B}$  is  $-\text{CO}-\text{O}-$ ,  $-\text{NHCO}-\text{O}-$  or  $-\text{NHCONH}-$ , letter  $c$  is an integer of 2 to 8, and  $c'$  is an integer of 1 to 7.

5. (Amended) The high molecular weight silicone compound of claim 4 wherein the crosslinking group having C-O-C linkages represented by the general formula (3a) or (3b) is represented by the following general formula (3a''') or (3b'''):



wherein each of  $\text{R}^3$  and  $\text{R}^4$  is independently hydrogen or a normal, branched or cyclic alkyl group of 1 to 8 carbon atoms, or  $\text{R}^3$  and  $\text{R}^4$ , taken together, may form a ring, and each of  $\text{R}^3$  and  $\text{R}^4$  is independently a normal or branched alkylene group of 1 to 8 carbon atoms when they form a

ring,  $R^5$  is a normal, branched or cyclic alkylene group of 1 to 10 carbon atoms, letter d is 0 or an integer of 1 to 5,  $A'$  is a  $c''$ -valent normal, branched or cyclic alkylene, alkyltriyl or alkyltetrayl group of 1 to 20 carbon atoms or arylene group of 6 to 30 carbon atoms, which may have an intervening hetero atom and in which the hydrogen atom attached to a carbon atom may be partially replaced by a hydroxyl group, carboxyl group, acyl group or fluorine atom, B is -CO-O-, -NHCO-O- or -NHCONH-, letter c" is an integer of 2 to 4, and  $c'''$  is an integer of 1 to 3.

Since claims 16-21 are newly added, no marked-up version is necessary.